Title: TBA

Date: Apr 09, 2015 02:30 PM

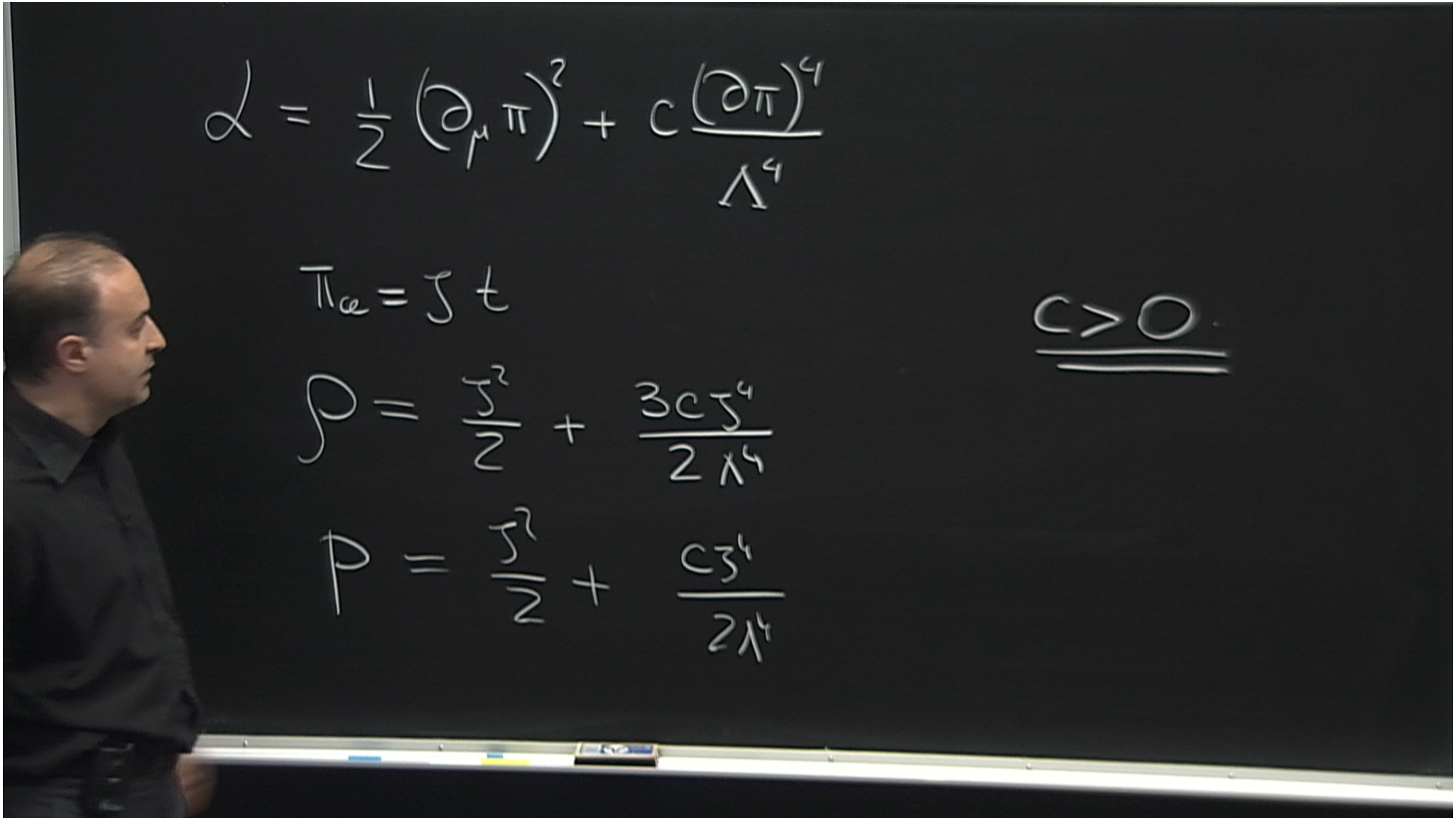
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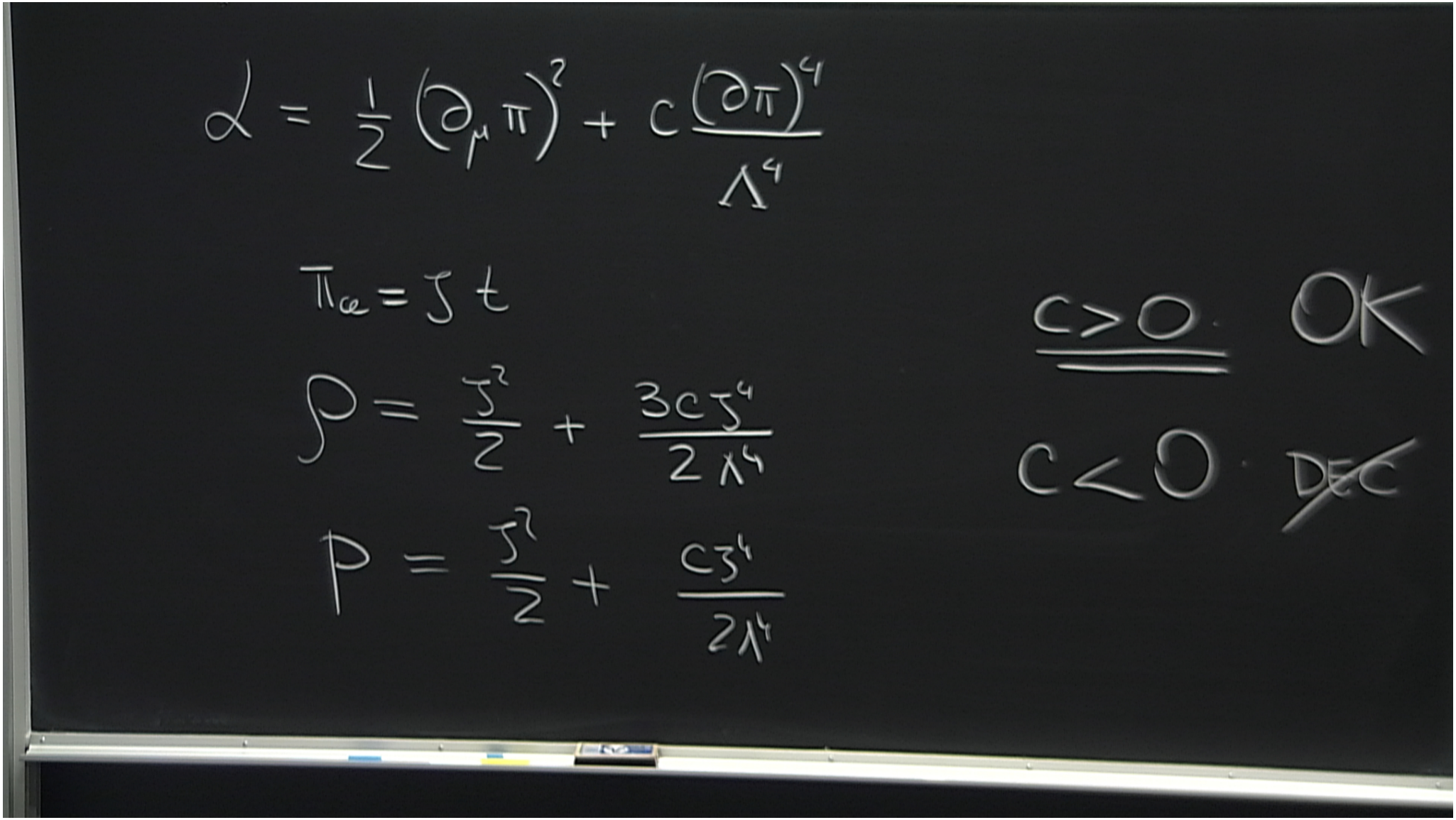
Abstract:

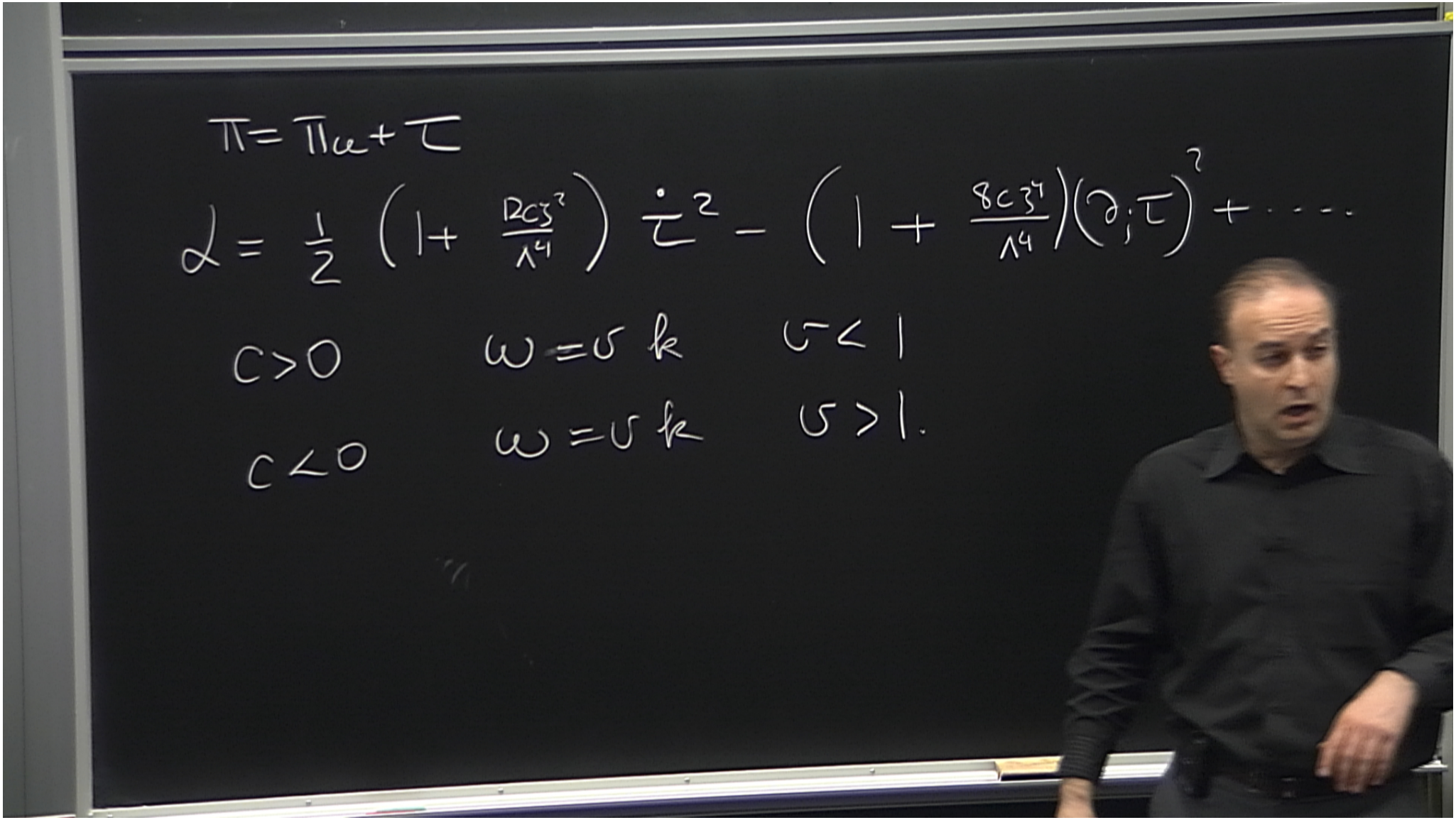
$$\mathcal{L} = \frac{1}{2}(\partial_\mu \pi)^2 + c\frac{(\partial\pi)^4}{\Lambda^4}$$

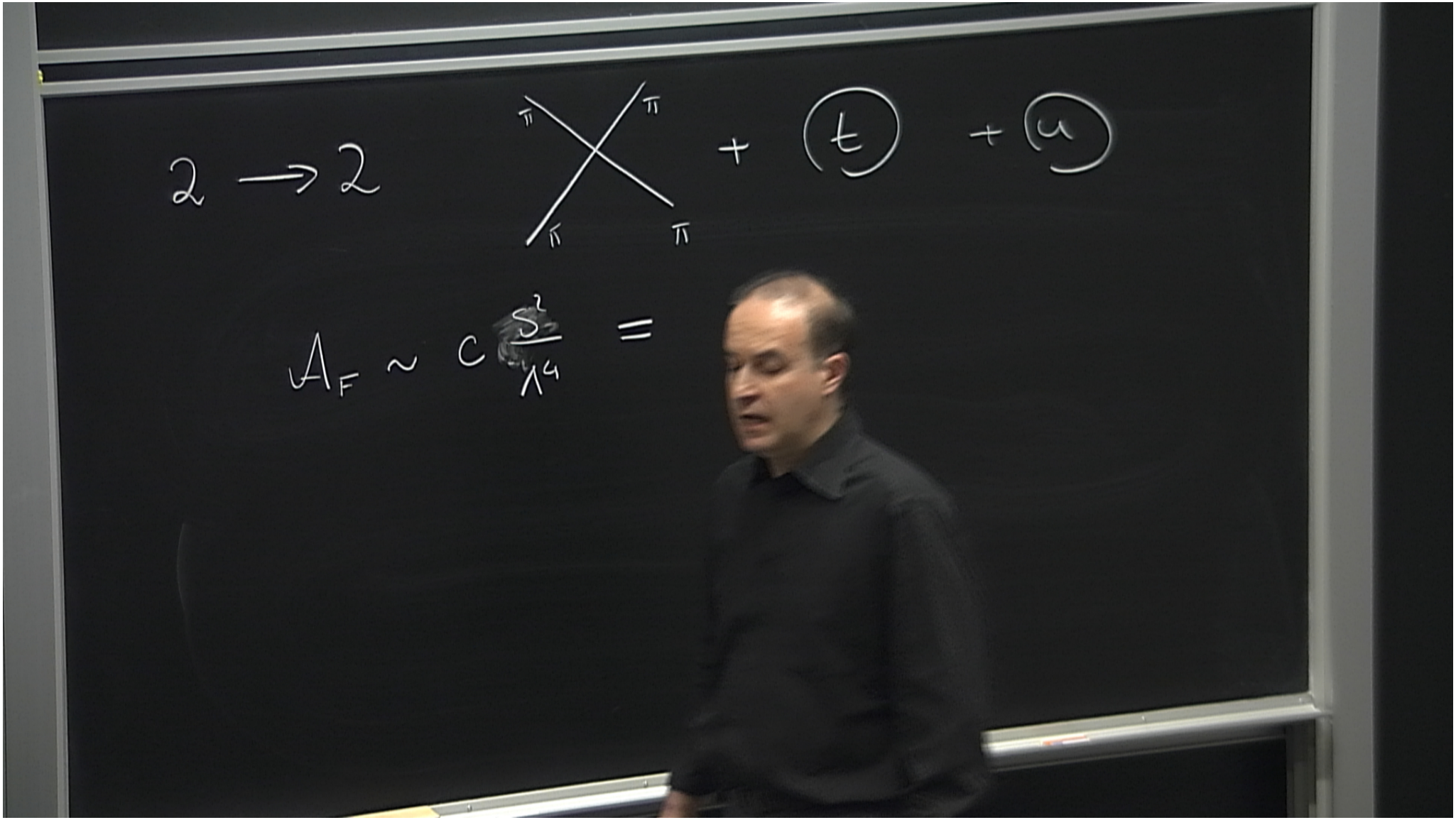
$$\mathcal{L} = \frac{1}{2}(\partial_\mu \pi)^2 + c\frac{(\partial\pi)^4}{\Lambda^4}$$

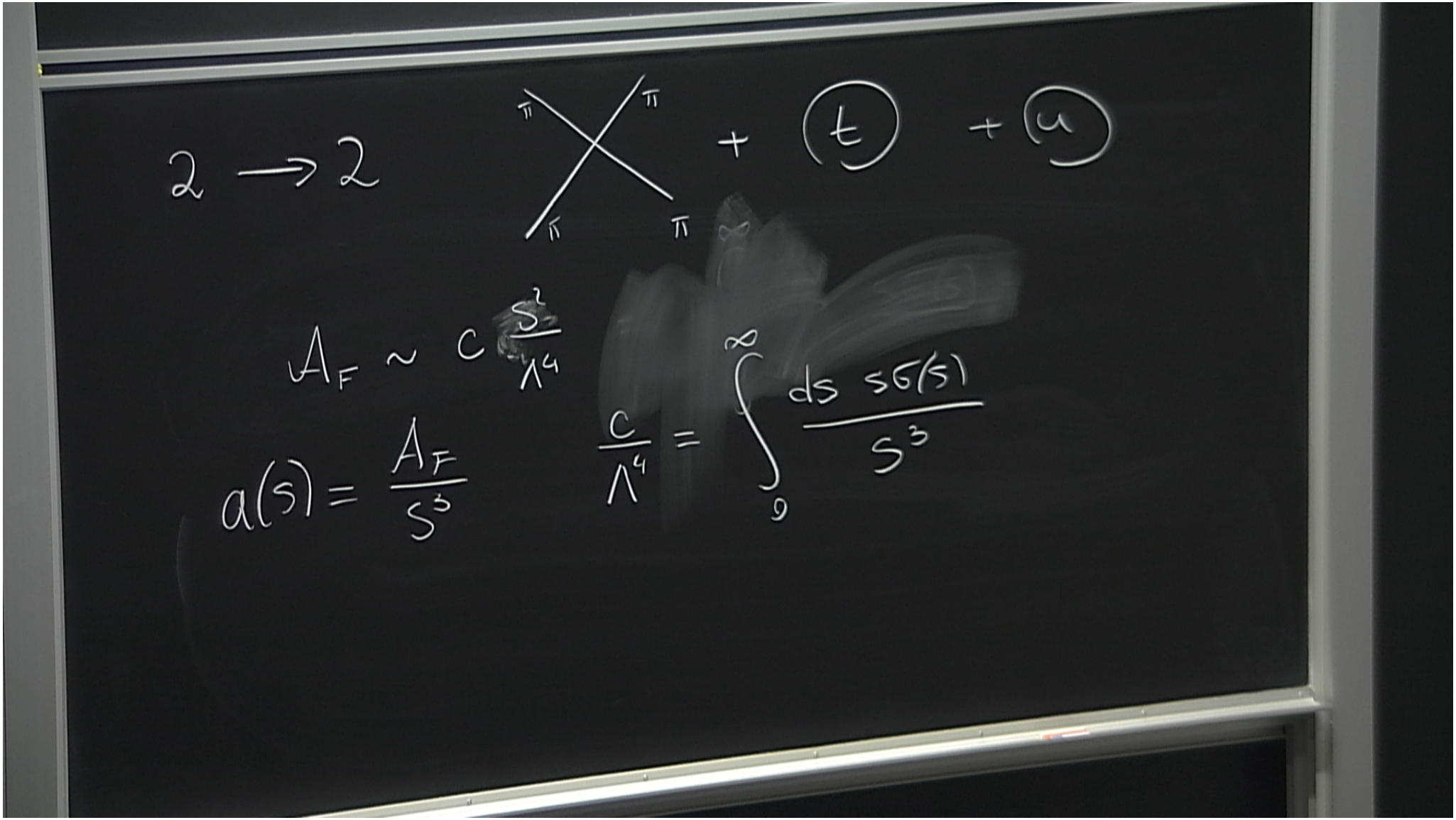
$$\pi_{cl} = Jt$$

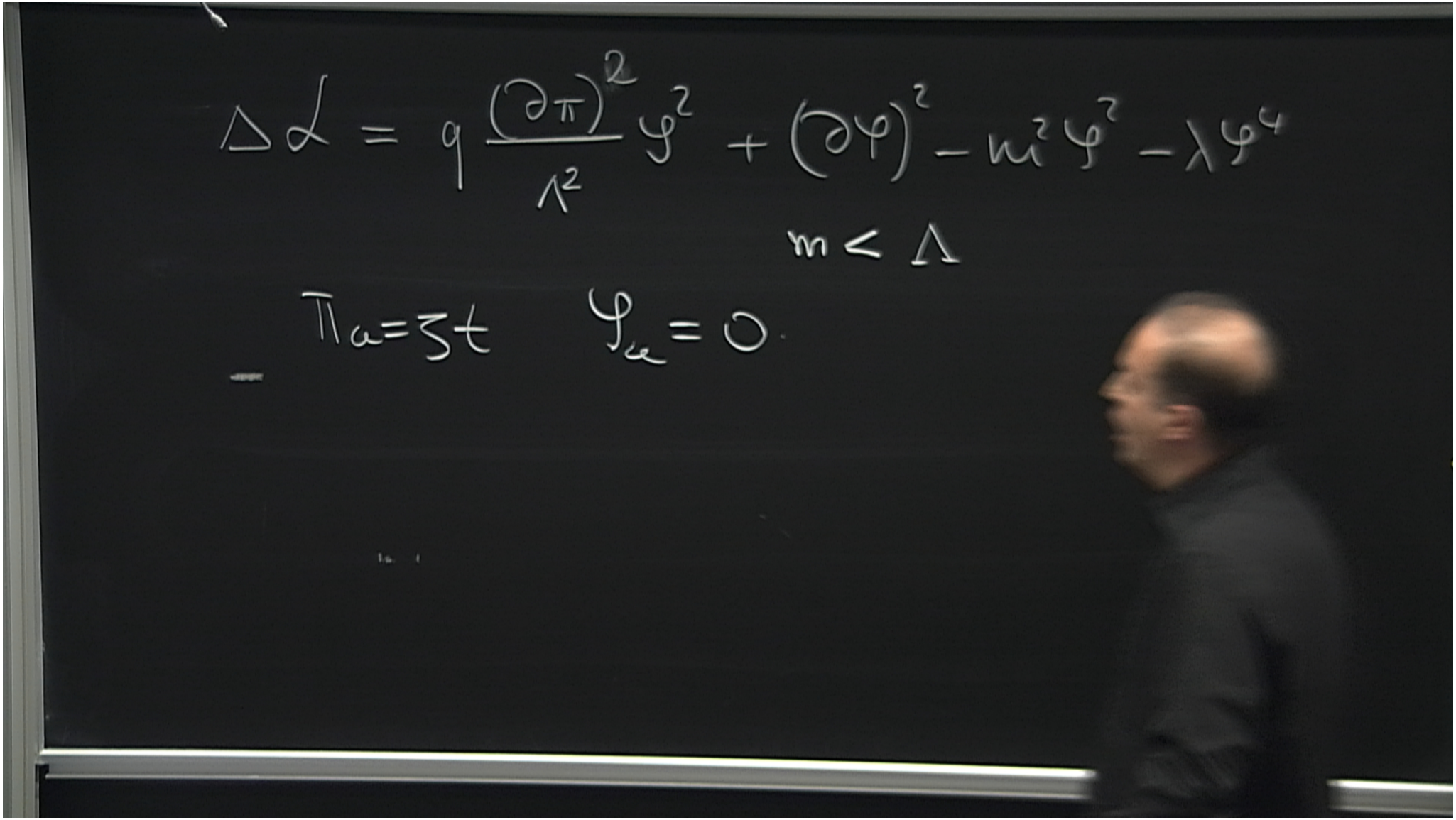

$\mathcal{L} = \frac{1}{2}(\partial_\mu \pi)^2 + c\frac{(\partial\pi)^4}{\Lambda^4}$
$\pi_{cl} = Jt$
$c > 0$
$\rho = \frac{J^2}{2} + \frac{3cJ^4}{2\Lambda^4}$
$P = \frac{J^2}{2} + \frac{cJ^4}{2\Lambda^4}$


$\mathcal{L} = \frac{1}{2}(\partial_\mu \pi)^2 + c\frac{(\partial\pi)^4}{\Lambda^4}$
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$P = \frac{J^2}{2} + \frac{cJ^4}{2\Lambda^4}$
$c>0$ OK
$c<0$ ~~DEC~~


$\pi = \pi_\omega + \tau$
$\mathcal{L} = \frac{1}{2}\left(1 + \frac{Rc^3}{\Lambda^4}\right)\dot{\tau}^2 - \left(1 + \frac{8c^3}{\Lambda^4}\right)(\partial_i \tau)^2 + \cdots$
$c > 0 \qquad \omega = v\,k \qquad v < 1$
$c < 0 \qquad \omega = v\,k \qquad v > 1.$


2 → 2
π
π
π
π
+ (t) + (u)
$A_F \sim c \frac{s^2}{\Lambda^4} =$


$2 \to 2$
π
π
π
π
+ (t) + (u)
$A_F \sim c \frac{s^2}{\Lambda^4}$
$a(s) = \frac{A_F}{s^3}$
$\frac{c}{\Lambda^4} = \int_0^\infty \frac{ds\ s\sigma(s)}{s^3}$

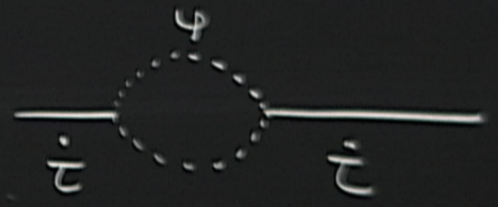

$\Delta\mathcal{L} = q\frac{(\partial\pi)^2}{\Lambda^2}\varphi^2 + (\partial\varphi)^2 - m^2\varphi^2 - \lambda\varphi^4$
$m < \Lambda$
$\pi_a = 3t \quad \varphi_a = 0$

$$\Delta\mathcal{L} = q\frac{(\partial\pi)^2}{\Lambda^2}\varphi^2 + (\partial\varphi)^2 - m^2\varphi^2 - \lambda\varphi^4$$

$$m < \Lambda$$

$\pi_a = 3t \qquad \varphi_a = 0$

$$qJ\cdot\frac{1}{\Lambda^2}\,\dot{\tau}\,\varphi^2$$



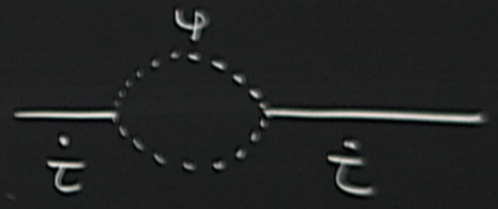
$$q^2\frac{J^2}{\Lambda^4}\,\dot{\tau}\left(\ln\frac{\Lambda^2}{m^2}\right)\dot{\tau}$$

$$\Delta\mathcal{L} = q\frac{(\partial\pi)^2}{\Lambda^2}\varphi^2 + (\partial\varphi)^2 - m^2\varphi^2 - \lambda\varphi^4$$

$$m < \Lambda$$

$\pi_a = \zeta t \qquad \varphi_a = 0$

$$q\zeta\frac{1}{\Lambda^2}\dot{\tau}\varphi^2$$



$$q^2\frac{\zeta^2}{\Lambda^4}\dot{\tau}\left(\ln\frac{\Lambda^2}{m^2}\right)\dot{\tau}$$

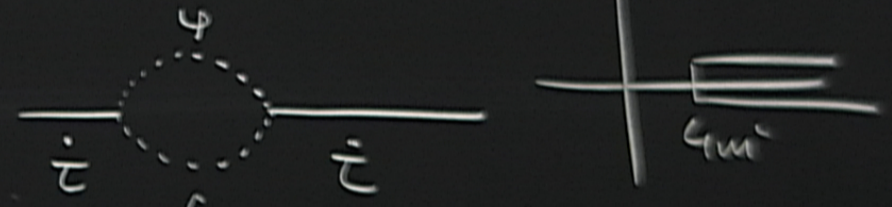
$$\Delta\mathcal{L} = q\frac{(\partial\pi)^2}{\Lambda^2}\varphi^2 + (\partial\varphi)^2 - m^2\varphi^2 - \lambda\varphi^4$$

$m < \Lambda$

$$\int_0^1 dx \ln\left(\frac{m^2 - sx(1-x)}{\Lambda^2}\right)$$

$\pi_a = \zeta t \qquad \varphi_a = 0$

$$q\zeta\frac{1}{\Lambda^2}\dot{\tau}\varphi^2$$



$$q^2\frac{\zeta^2}{\Lambda^4}\dot{\tau}\int\left(\ln\frac{\Lambda^2}{m^2 - sx(1-x)}\right)dx\,\dot{\tau}$$

$$\Delta\mathcal{L} = q\frac{(\partial\pi)^2}{\Lambda^2}\varphi^2 + (\partial\varphi)^2 - m^2\varphi^2 - \lambda\varphi^4$$

$m < \Lambda$

$$\int_0^1 dx \ln\left(\frac{m^2 - sx(1-x)}{\Lambda^2}\right)$$

$\Pi_a = 3t \qquad \varphi_a = 0$



$$q\frac{3}{\Lambda^2}\dot{\tau}\varphi^2$$

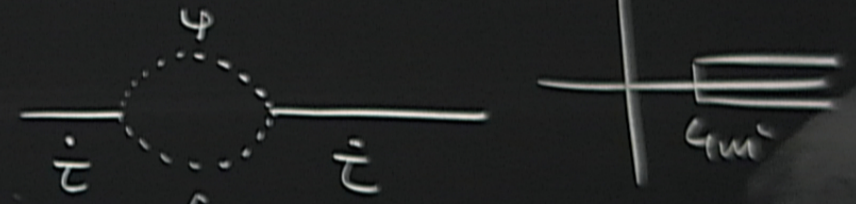
$$q^2\frac{3^2}{\Lambda^4}\dot{\tau}\int\left(\ln\frac{\Lambda^2}{m^2 - sx(1-x)}\right)dx\,\dot{\tau}$$

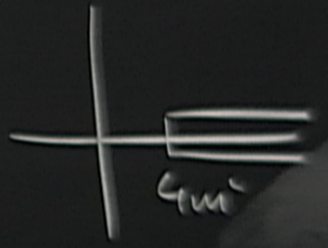
$$\Delta\mathcal{L} = q\frac{(\partial\pi)^2}{\Lambda^2}\varphi^2 + (\partial\varphi)^2 - m^2\varphi^2 - \lambda\varphi^4$$

$m < \Lambda$

$$\int_0^1 dx \ln\left(\frac{m^2 - s x(1-x)}{\Lambda^2}\right)$$

$\pi_\omega = \zeta_t \qquad \varphi_\omega = 0$





$$q\zeta\frac{1}{\Lambda^2}\omega\varphi^2$$

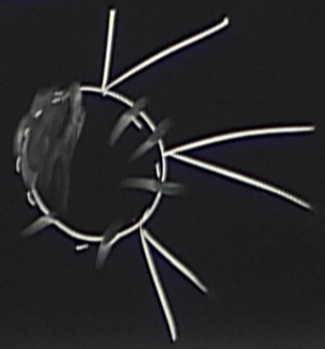
$$q^2\frac{\zeta^2}{16\pi^2}\omega\int\left(\ln\frac{\Lambda^2}{m^2 - s x(1-x)}\right)dx\,\omega$$

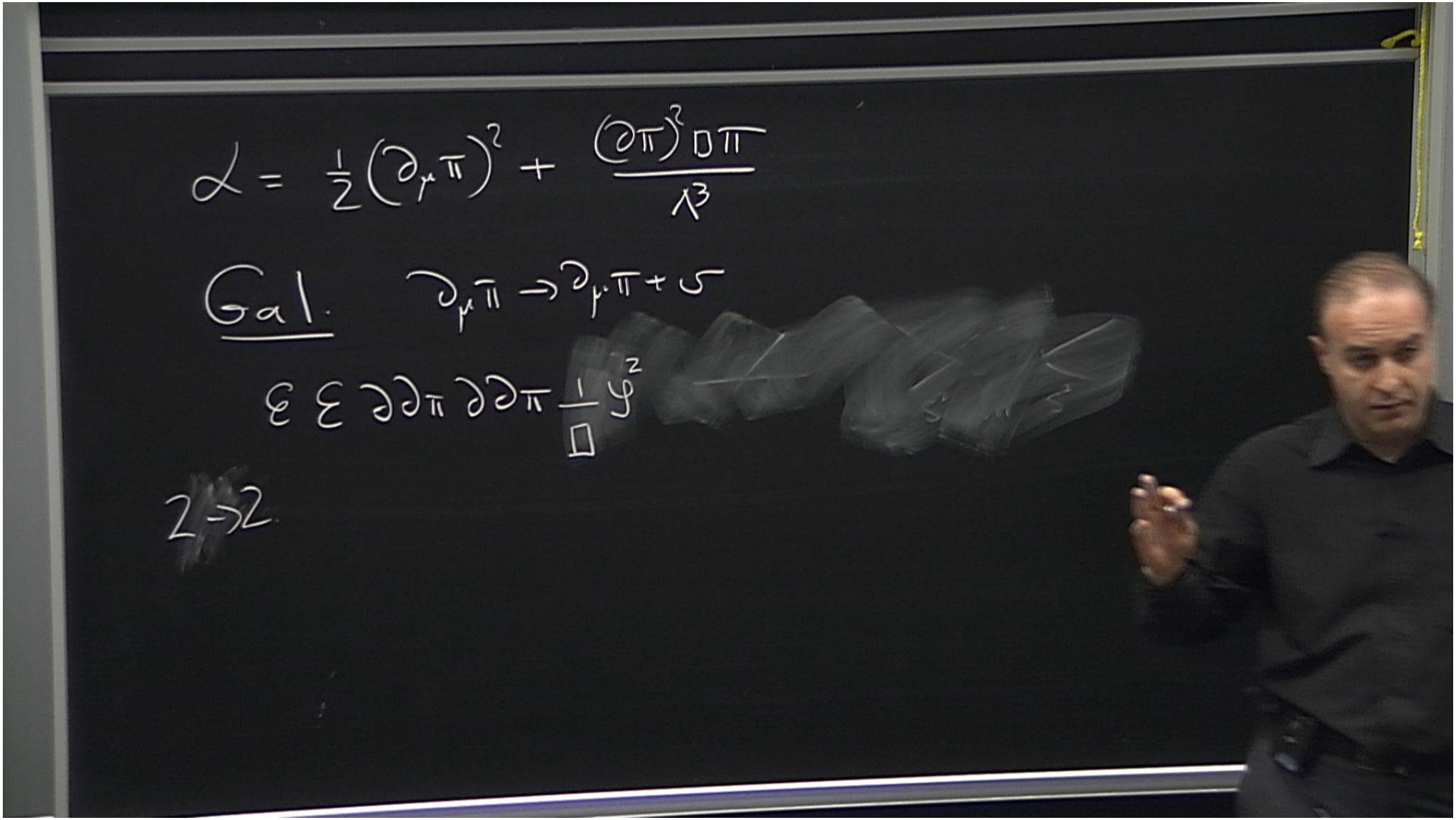
$\mathcal{L} = \frac{1}{2}\left(1 + \frac{|c|}{\Lambda^4}\right)\dot{\pi}^2 - \left(1 + \frac{|c|}{\Lambda^4}\right)(\partial_i \pi)^2 + \ldots$

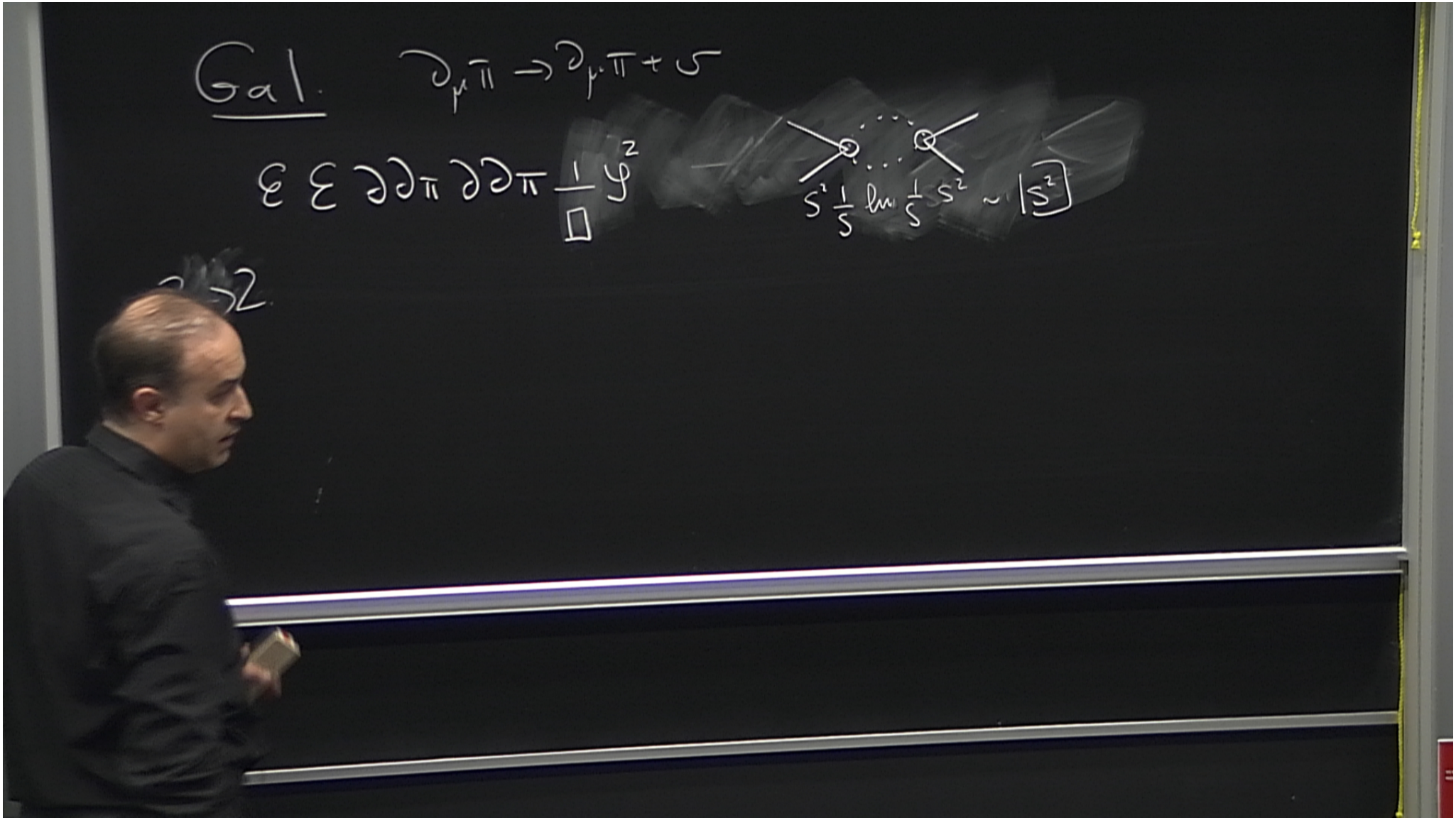
$c > 0 \qquad \omega = v\,k \qquad v < 1$

$c < 0 \qquad \omega = v\,k \qquad v > 1.$

$c > -9^2 \frac{\pi^2}{\Lambda^4}$

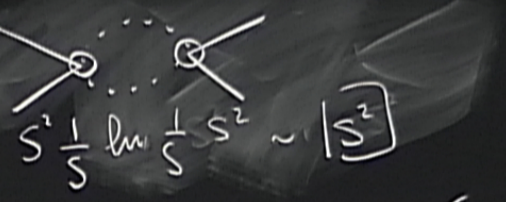



$\mathcal{L} = \frac{1}{2}(\partial_\mu \pi)^2 + \frac{(\partial\pi)^2 \Box\pi}{\Lambda^3}$
Gal. $\partial_\mu \pi \to \partial_\mu \pi + c$
$\varepsilon\varepsilon\partial\partial\pi\partial\partial\pi \frac{1}{\Box} g^2$
2->2


Gal.
$\partial_\mu\pi \to \partial_\mu\pi + c$
$\varepsilon\varepsilon\partial\partial\pi\,\partial\partial\pi\,\frac{1}{\Box}\varphi^2$
$s^2\,\frac{1}{s}\ln\frac{1}{s}\,s^2 \sim \boxed{s^2}$

Gal. $\partial_\mu \pi \to \partial_\mu \pi + \sigma$

$\varepsilon\varepsilon\,\partial\partial\pi\,\partial\partial\pi \frac{1}{\Box} \frac{\varphi^2}{m}$



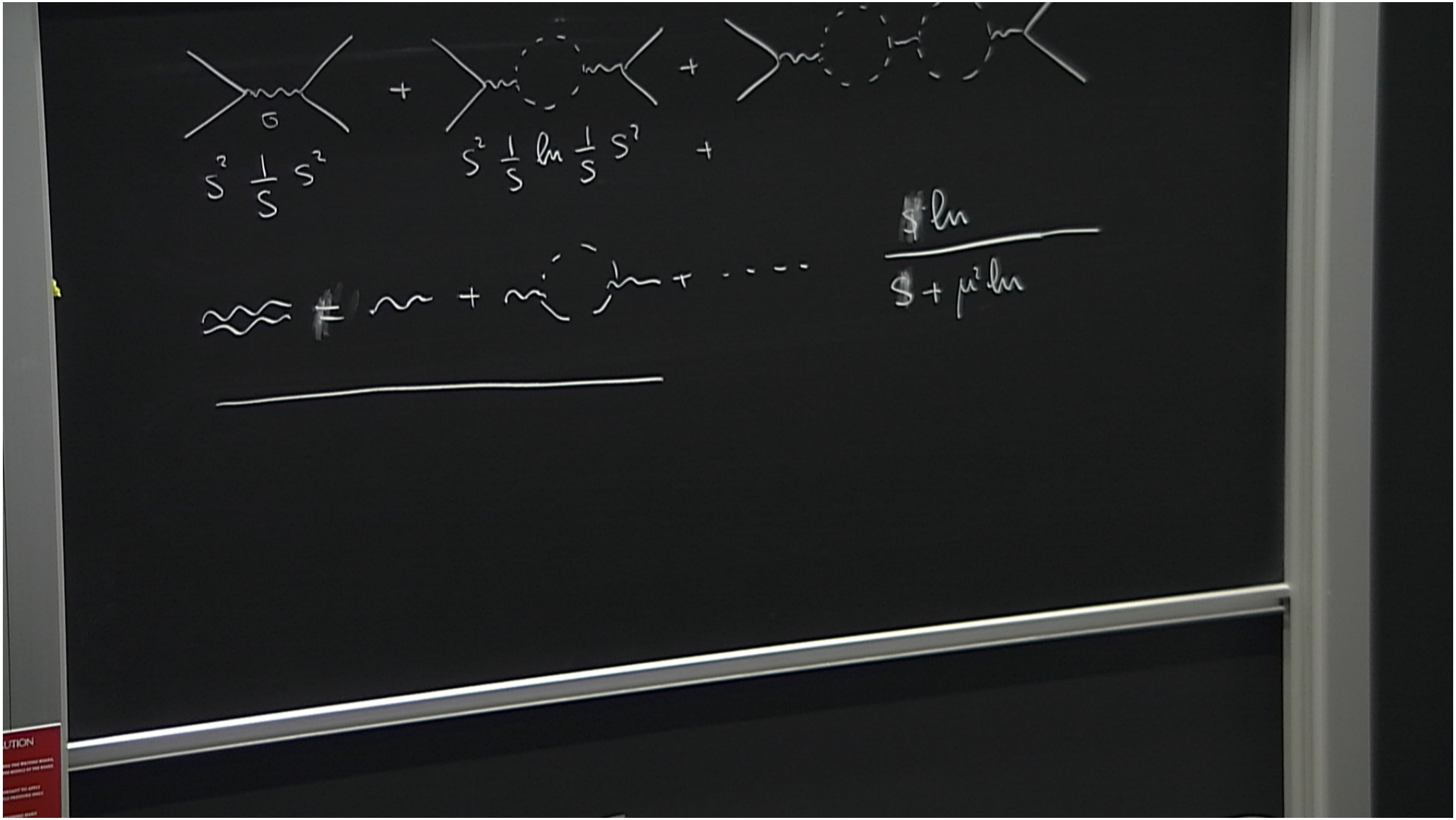
$s^2 \frac{1}{s} \ln \frac{1}{s} s^2 \sim |s^2|$

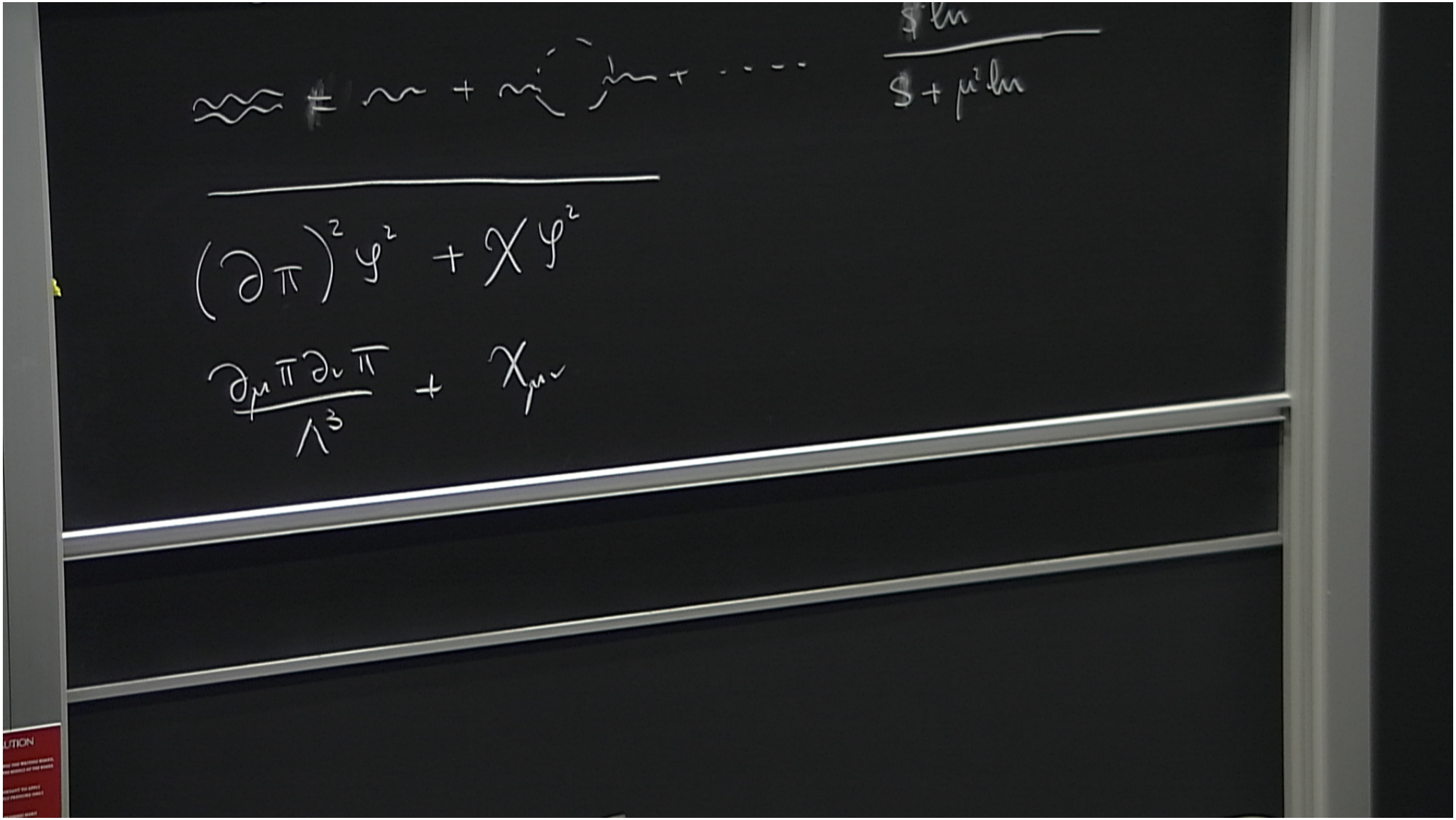
$2 \to 2$

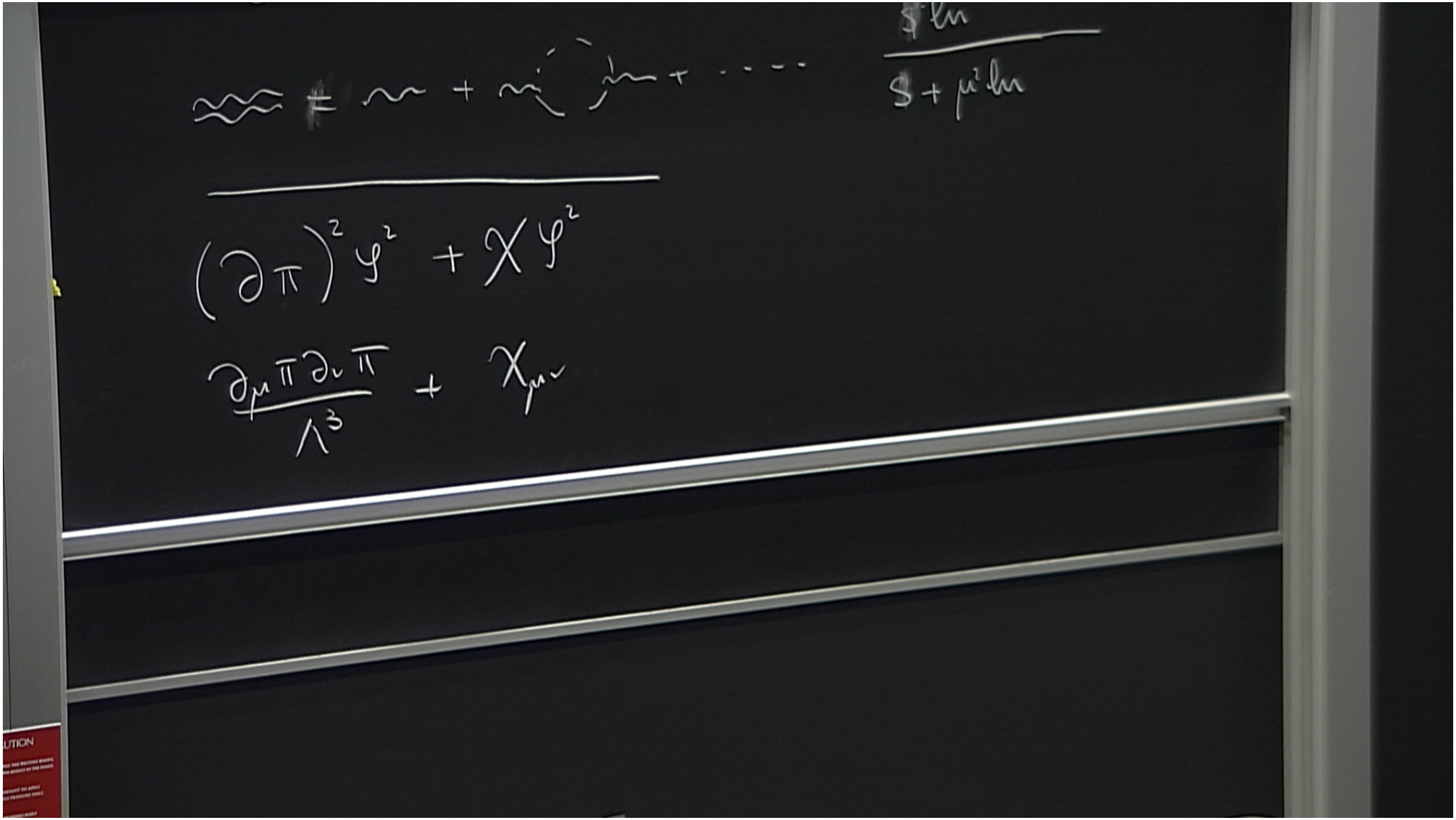
1) $(A+B)\sigma + (\partial\sigma)^2 \to (A+B)\frac{1}{\Box}(A+B)$.

$(A-B)\tilde{\sigma} - (\partial\tilde{\sigma})^2 \to -(A-B)\frac{1}{\Box}(A-B)$

2) $\left(\frac{\varepsilon\varepsilon\,\partial\partial\pi\,\partial\partial\pi}{\Lambda^3} + \mu\varphi^2\right)\sigma + (\partial\sigma)^2$


G
+
+
$s^2 \frac{1}{s} s^2$
$s^2 \frac{1}{s} \ln \frac{1}{s} s^2$
+
+ ....
$\frac{s \ln}{s + \mu^2 \ln}$


$\frac{s^4 \ln}{s + \mu^2 \ln}$
$(\partial\pi)^2 \varphi^2 + \chi\varphi^2$
$\frac{\partial_\mu \pi \partial_\nu \pi}{\Lambda^3} + \chi_{\mu\nu}$


$(\partial\pi)^2\varphi^2 + X\varphi^2$
$\frac{\partial_\mu\pi\partial_\nu\pi}{\Lambda^3} + X_{\mu\nu}$